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# PEST TECHNOLOGY

**PEST CONTROL AND PESTICIDES**

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## Contents





## A Matter of Common Sense

THE dangers of toxic pesticides and other agricultural chemicals to wildlife and human beings provide a lively topic for dispute in many parts of the world, and particularly in Britain. Less spectacular in its propaganda value in the hands of the "anti-s" but which causes concern to responsible groups within the industry is the risk of personal harm to operators of spraying equipment by careless handling of some products. These risks take the form of physical contact with liquids (and consequent absorption into the system), by inhaling fumes, and by passing contaminated food into the stomach.

Pest control techniques have developed in recent years at a pace which has not been fully matched by an awareness of their various hazards. Most manufacturers make suggestions for safe handling of their chemicals at the time of sale, but two leading producers have recently shown how little attention these warnings really receive. The problem, in short, is how many people read the label?

The Stauffer Chemical Co., for example, has recently been using advertising space in agricultural journals to give a warning about the labels. Beneath the headline, "The Most Important Four Minutes in Pest Control", the company points out that reading the label carefully and following its directions exactly will lead to better and more economical results, as well as greater personal and crop safety. "An extra spoonful for the pot", the advertisement warns, is a bad rule when mixing chemicals.

Even more forceful is the appeal to be found in a new film just made by the Shell Film Unit for showing at conferences and meetings attended by personnel concerned with pest control. This depicts the precautions necessary by those who handle chemicals in temperate and tropical climates, and admirably shows how most of the risks can be eliminated by common-sense handling methods.

This is a problem that will not diminish with time, for it provides an instance where continued familiarity breeds danger.

Because there are regulations in many countries stipulating the use of such equipment as respirators, goggles and protective clothing with dangerous chemicals, the real need now is for a campaign within the industry to ensure that these are enforced.

# INSECT CONTROL IN FARM GRANARIES

By E. R. GOODLIFFE, M.A., Ph.D.*



THE MORE INTENSIVE production methods which have recently been instituted in farming practice have naturally produced unexpected problems, and amongst these is the problem of storing grain after harvesting.

By the use of strains of wheat, barley and the like specially selected and bred to produce plants which are not only more resistant to disease but also give heavier yields, and by the prior application of suitable fertilisers, much heavier crops are now obtained. For instance, the average yield of barley per acre, in England and Wales, in 1948-1949 was 19.4 cwt., while ten years later the figure was 22.8 cwt., the total production for England and Wales increasing from approximately 1.8 million tons to 2.8 million tons in the same period, though with a slight acreage increase[1]. Again, the use of combine harvesters has very naturally increased over the last decade. These machines cut the crop, separate the grain from the rest of the plant, and collect the grain in sacks or in bulk.

It follows that grain in quantity and immediately ready for storage after drying is obtained by the use of combine harvesters. It has therefore been necessary for the farmer to provide suitable accomodation, and this has been done by the erection of silos of various types usually within existing farm buildings.

### Silo construction

These silos are constructed either of wood, brick, metal or prefabricated concrete blocks, each silo or bin capable of holding grain up to 30 or 40 tons capacity, and the total grain stored depends on the requirements and financial resources of the owner. Associated with this storage must be the provision of such ancillary machinery as receiving pits or hoppers, drying and dressing machines, and conveyors and elevators to transport grain from one point to another. Capacity of such farm storage naturally varies from the small unit of, say, 30 tons of grain, used for animal feed by the owner, to large units capable of holding more than 2,000 tons.

These units are often installed in farm buildings already in existence, and since there is naturally the intention of obtaining the maximum amount of holding capacity within the walls of the old buildings, the walls of the bins themselves are placed very near the existing walls, leaving between the two walls an inaccessible gap, into which spillage of grain will occur. No doubt the farm buildings previously supported a small endemic population of insects, which, under the new conditions of grain storage in bulk, gradually increases until, within a space of two or three years, the farmer suddenly notices a moving mass of small insects in his grain, with the

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* *Ratsouris Ltd., London.*

result that, when the grain comes to be sold the buyer may refuse delivery.

#### Commonest insects

The insect most frequently found to be responsible for infestation of farm granaries is the saw-toothed grain beetle, *Oryzaephilus surinamensis*. This is a small reddish brown beetle, $\frac{1}{8}$ in. long, which, when observed under a magnifying lens, will be seen to have serrated edges to the thorax. This insect has a high rate of breeding, the female being capable of laying some 400 eggs, the larvae feeding on the germ of the grain, and on grain dust and debris. The period from oviposition to adult emergence varies, according to temperatures and humidity, from twenty-five days at 30°C (86°F), to sixty days at 20°C (68°F). Howe[2] (1956) states that at a temperature of 33°C (91°F), this insect will multiply approximately fifty times every month, and this accounts for the apparent suddenness with which this insect frequently becomes noticeable in extremely large numbers, when the insects spread away from the grain, invade the structure of the granary, and infest clean grain.

It has been previously mentioned that the source of such an infestation might have been a small endemic population of these insects in the farm buildings prior to the erection of silos, and many cases of heavy infestation of grain in farm granaries have been caused in this way; usually two or three years after installation. Other causes of infestation include the use of infested sacks, the entry of infested grain into clean silos, and the transportation of grain in bulk or in sack in infested lorries or wagons.

In a similar way, infestation of grain by grain weevils (*Sitophilus granarius*) also occurs in farm granaries, and while the number of insects present does not often reach such spectacular proportions as occur with saw-toothed grain beetle, the actual damage to grain caused by weevils is often as great or even greater. This is because the female adult weevil lays its eggs inside the grain, (about 100 to 200 eggs are laid by a single female), and the larvae hatching from these eggs bore into the grain, and feed on its entire contents, eventually pupating and emerging as the adult beetle, so starting the cycle all over again. There may be three or four generations each year, although breeding activity is reduced during winter months except when heating of grain occurs. For these reasons and after severe infestations of weevils, seed grain, or grain destined to be milled may not be suitable for these purposes, with consequent loss of value.

Another beetle occasionally found infesting farm granaries is the flour beetle (*Tribolium confusum*). These beetles have a similar rate of increases as saw-toothed grain beetles. The female adult beetles lay up to 400 eggs, scattering them loosely amongst the grain, and when the larvae hatch, they feed on the broken grains and grain dust, reaching the adult stage in a month at 30°C (86°F). Like the saw-toothed grain beetle, flour beetles will not multiply at temperatures below 20°C (68°F).

Other beetles infesting farm granaries, but usually in small numbers, include *Cryptolestes* sp., *Cryptophagus* sp., and *Typhaea stercorea*, the latter two being associated with damp conditions. Moths of various species are sometimes present and are more frequently associated with the milling of grain for animal feed, when the dust produced settles on surrounding areas and enters cracks and crevices. In this region moth larvae are often located, with moth pupae found in the roof joists, wedged in cracks and crevices from which the adult flying moth will eventually emerge.

Mites are also frequently found associated with grain in farm granaries, more particularly in those granaries situated in northern England and Scotland. Their presence is usually related to damp conditions of storage or damp grain, since mites do not infest grain which has a moisture of less than 12 per cent. Mites themselves are very small animals (not insects) with four pair of legs, and can be best observed under a hand lens. They, too, have a rapid rate of multiplication under favourable conditions of temperature and humidity.

#### Heating of grain

As previously mentioned, grain weevils infesting grain cause damage by eating the contents of grain, so interfering with the germination. On the other hand, saw-toothed grain beetles, cause damage by heating the grain locally to form "hot-spots". The heat contributed by the insects is unable to escape quickly enough (grain being a poor conductor of heat), and so the temperature gradually rises. This in turn speeds up the development of insects, so adding to their numbers and therefore contributing further heat. These areas become so hot as to drive the insects in all directions, spreading the "hot-spot" which may ultimately achieve a temperature of up to 50°C (110°F), the grain becoming "caked". If maintained for a sustained period this will make the grain entirely valueless except for animal feed. It will certainly cause an associated dampness of grain culminating in premature "sprouting" of surface grain.

#### Mechanical control

The current practice among many of the larger grain growers and some of the smaller ones, of installing their own silos for the bulk storage of grain on their land can thus be seen to be attended by insidious dangers, but fortunately the owner can do much to reduce the likelihood of insect infestation and so maintain the value of his crop.

In the first place, the installation of silos and the necessary machinery requires careful planning, the possible incidence of insect attack often being overlooked. It is therefore important to insure that if spillage of grain

occurs from the silo bin itself, sufficient space is available to be able to remove it. The silos themselves, if constructed of prefabricated concrete blocks, should have the joints sealed with a bitumastic compound, so that no cracks and crevices are presented in which insects may breed undisturbed. All machinery should be kept away from walls, if possible, so that adequate cleaning all round is possible, and elevator bottoms so constructed as to be easily cleaned. It is also important to see that the roof is waterproof and that gutters and rain pipes are kept clean and in good condition.

There also appears to be a connection, too, between the presence of rodents, either rats or mice, in the granary and an infestation of insects. Perhaps this association is only responsible for the spread of insects by rodents, but it is sufficiently close to suggest rodent control as being of importance in good grain storage practice.

It should be remembered that all grain harvested in this country is entirely free of insects likely to infest it during storage. This grain, after passing to the silos, through infested elevators, dressing and drying machines, is then stored in ideal conditions for the infestation to increase very considerably, with consequent damage to the grain itself and to its value.

It therefore pays to remove all old sacks and sacking, and to sweep out and burn all accumulated residues of grain and debris from all parts of the farm granary when empty, giving particular attention to bins, dressing and drying machinery, and conveyors, and all these areas should be thoroughly sprayed with an insecticide. New season's grain should be well dressed and dried before storage, the degree of drying depending on the probable length of storage.

#### Chemical control

The choice of insecticide is naturally important. During the last five years or so, malathion has been found to have excellent insecticidal action on those insects infesting farm granaries. Although malathion belongs to the group of organo-phosphorus compounds, it is one of the least toxic to animals other than insects. For example, the Advisory Committee on Poisonous Substances used in Agriculture and Food Storage in October 1958 recommended the admixture of malathion as a dust or emulsion spray direct to raw unprocessed grain, provided the amount of actual malathion applied does not exceed 10 oz. per 1,000 bushels. Reference to the effectiveness of malathion admixture will be made later.

Prior to the use of malathion, sprays based on lindane (gamma BHC) were extensively used in treatment of farm granaries, and this insecticide could also be admixed with grains at a rate not to exceed 2.5.p.p.m. Unfortunately, lindane is not so effective in the control of saw-toothed grain beetle as malathion, and, for this reason, the latter insecticide is becoming frequently and extensively used in farm granary insect control.

Not only is it important to decide the insecticide to be used, but also the manner of its formulation and application. Best results, for instance, are obtained if malathion is made up as a dispersible or wettable powder, which is diluted with water, the powder then being dispersed or held in suspension in the water, and the whole being evenly applied by pressure sprayer to all surfaces. In this way, insects actually contacted by the spray are killed as well as those subsequently walking over the sprayed surfaces. In fact, malathion is a surprisingly long-lasting insecticide, in spite of the known observation that it breaks down in the presence of water and alkalis, such as may be present in lime washed walls. For the purpose of spraying farm granaries and similar premises, malathion dispersible powders containing 30 or 25 per cent premium grade malathion are readily available. These should be diluted with water at the rate of 8 oz. or 10 oz. respectively per gallon of water, and this amount sprayed evenly over about 1000 sq. ft., paying special attention to cracks and crevices, machinery and conveyor systems. It has been shown that the sprayed surface will remain toxic to insects walking over it for a period of many months.

If such a comprehensive and thorough spraying of the farm granary is carried out with malathion spray, after a complete cleaning—vacuum cleaning if necessary—and removal of spillage and debris, then the clean grain dried to 14—16 per cent M.C. (according to probable length of storage) introduced into the silos after harvesting will remain clear of infestation throughout the ensuing storage period, provided again that insects are not later introduced into the silos by using infested sacks or other similar source.

#### Admixture

As an additional precaution, it is possible to admix malathion with grain, as previously mentioned, provided the amount of applied malathion does not exceed 10 oz. per 1,000 bushels. For this purpose, malathion is first blended as a 2% malathion mineral dust, using either an inert filler or a cereal filler, both in finely divided form. Such a mixture is added to the grain intake, after dressing and drying, at the rate of 1 lb. per ton. This additional protection will cost about 1s. per ton, according to the amount of grain involved, and the cost can be further reduced without much loss of efficiency if malathion dust is applied in "sandwich" form, that is to say, if a layer of malathion dust is applied evenly over the surface of a depth of grain of 2ft., followed by a further similar depth of grain, then more malathion, and so on till the silo is filled.

Papworth[3] (1961) has confirmed experimentally the

value of malathion, either in total admixture, or by the "sandwich" technique, in controlling and preventing insect infestation, though he notes that the method is likely to be unsatisfactory if the moisture content of grain is over 15 per cent. He describes various types of equipment available for the admixture of malathion with grain and answers objections which might be raised on the subject of possible taint, toxic hazards and effects on grain germination.

He states that an amount of about 100,000 tons of grain is known to have been treated by admixture through the recommendations of the British Ministry of Agriculture, Fisheries & Food, and this figure may well be doubled to include commercial operations. The success of the method will undoubtedly lead to its wider use.

#### Fumigation methods

It frequently happens that no precautions are adopted in the prevention of insect attack in farm stored grain, and sooner or later, the grain becomes heavily infested, perhaps even before the owner has observed any insects at all.

While the problem of controlling such a heavy outbreak is usually relatively simple, it is also somewhat expensive and this underlines the accuracy of the old adage that "prevention is better than cure". Control is obtained generally by fumigation of the infested grain, which is, after all, stored in bins usually suited to this method, though naturally special precautions have to be taken where ventilating or forced draught bins are infested.

One of two methods of fumigation is used. The first involves the use of tablets available under the name Phostoxin, which contain aluminium phosphide and ammonium carbamate. These, in contact with moisture, evolve a toxic phosphine, gas and if the concentration of this gas is high enough and maintained for a sufficient period, insects, including eggs, larvae, pupae and adult stages, are all killed. The method therefore is to distribute these tablets throughout the grain as accurately as possible at intervals of 1 yd. both in depth and width, the grain being covered afterwards with sheets or tarpaulins, any other means of escape of the gas also being previously sealed. It must be remembered that this gas in sufficient quantities is also toxic to human beings, and so great care is needed in application, with the use of a suitable gas mask if large quantities of grain are being fumigated, and the grain must also be adequately ventilated afterwards.

Similar precautions apply to the second method of fumigation of farm granaries by the use of liquid fumigants, containing a mixture of ethylene dichloride and carbon tetrachloride. These liquids, mixed in the proportion of 3 parts to 1 part respectively, may be used in the fumigation of empty sacks, bagged grain, and grain in bulk, where the depth of grain does not exceed 8ft. For bulk grain of greater depth, the mixture should be used in equal proportions, when the increased amount of carbon tetrachloride gives better penetration of the gases at greater depths.

In application, the liquid, mixed as noted above, is poured over the infested grain, as evenly as possible, at the rate of 1 gallon per 5 tons of grain for seven days, while for grain in sacks, the application rate should be 7 gallons per 10 tons for 48 hours. Empty sacks may be treated, tied together in bundles of twenty, in a small fumigation chamber, or by enveloping them in sheets quickly after pouring the liquid over them evenly at the rate of 2-3 pints per cwt. for 48 hours. In all cases, it is undesirable to breathe the vapours of this mixture, and if prolonged exposure is likely, a gas mask must be worn.

Fumigation of infested grain is not sufficient in itself to control insect infestation, which will probably have spread to the structure of the farm granary, and so, it is also necessary to spray the outside of bins, and the insides to the level of the grain, prior to fumigation, as well as all other sections of the granary.

In some farm granaries, silo bins, either of wood, brick, concrete or steel, have not been installed, and the farmer has been content to store grain in bulk held in place by bulkheads of grain in sacks. Here again, insects, mainly saw-toothed grain beetle, are likely to infest the grain, either from a small endemic population in the farm granary from previous years, or from infested sacks used for the bulkhead.

#### Endemic population

Such an infestation does present some difficulties in control, for fumigation is the only likely answer and this must be done in conditions unfavourable to the process. The granary has been first adequately cleared of infestation by spraying all surfaces of the granary with malathion dispersible powder, which is also applied to the bulkhead grain in sacks, and then all the grain is fumigated by ethylene dichloride/carbon tetrachloride mixture (3:1), poured over the grain and bulkheads, the whole being covered with tarpaulins or polythene gas proof sheets, ensuring that no leakage of fumigant is possible from the base of the sheets. Extra fumigant is applied to the bulkhead grain in sacks at the rate of 1 gal. of fumigant per 3 tins, instead of the usual 1 gal. per 5 tons for bulk grain. After completion of fumigation, and when the sheeting has been removed, the surface of the grain is dusted with malathion dust (2 per cent), at the rate of 30 lb. per 1,000 sq. ft., as an additional precaution.

Enough has been said to indicate that there is a fairly regular pattern in the development of insect infestation in farm granaries, and in the methods adopted either to prevent infestation or to control it. It is also true that

*Continued on p. 275*

# EFFECT OF ORGANIC HERBICIDES ON SOIL MICRO-ORGANISMS

By Wm. W. FLETCHER,* B.Sc., Ph.D., F.L.S.

*It is important to determine, says the author, what effect organic herbicides have on the micro-organisms that are concerned with the nitrogen cycle in the soil.*

ONE OF THE major developments in agriculture since the Second World War has been the introduction of organic herbicides for the control of weeds. Recent estimates[1] indicate that some 35 million acres of land in the U.S.A. are sprayed annually with herbicides, 30 millions of them with substituted phenoxyacetic acids. In Europe (excluding the U.K.) more than 7,600 metric tons of herbicides were used in 1956[2]. Figures for the U.K. are not obtainable but estimates indicate that some 2-3 million acres are sprayed annually.

A proportion of any chemical being applied to crops will reach the soil; some herbicides, e.g. those of the pre-emergence type, are applied directly to the soil. It is important to determine what effect these chemicals, which are being used in ever-increasing amounts, have on the micro-organisms that are concerned with the nitrogen cycle in the soil.

Nitrogen plays a very important part in the life of the plant; forming an essential part of the proteins which go to make up the protoplasm, being a constituent of the chlorophyll molecule, and forming part of most, if not all, enzymes. Complex nitrogenous compounds are introduced into the soil by decaying animal and plant bodies or their products. These compounds are unavailable to plants and have to be converted into assimilable forms by mocro-organisms. Various bacteria and fungi convert the proteins to ammonium salts. These salts, in turn, are oxidised to nitrites by *Nitrosomonas* and the nitrites are oxidised to nitrates by *Nitrobacter*. These oxidation processes are termed nitrification and the organisms responsible are collectively known as the nitrifying bacteria.

Nitrogenous materials are constantly being leached out of the soil or taken out by means of crops and these materials must be replaced. They are not derived from rock fragments as are other fertilisers e.g. phosphates, and the only natural biological addition of nitrogenous substances to the soil is by the activity of certain micro-organisms which, living either saprophytically, e.g. *Azotobacter*, or symbiotically, e.g. rhizobia, are able to utilise the nitrogen gas of the air. The amounts of nitrogen fixed by these organisms (and thus eventually made available to higher plants) may be considerable, e.g. it has been calculated that one acre of red clover, well nodulated by rhizobia, may fix some 100 lb. of nitrogen gas per annum. This is the equivalent in nitrogen content to 6½ cwt. of Nitro-Chalk or 5 cwt. of sulphate of ammonia. It is obviously important that no substance introduced into the soil should interfere with the mass of soil micro-organisms, nor, in particular, with the nitrifying and nitrogen-fixing bacteria.

Readers desiring more detailed information on the effect of inorganic and organic herbicides on the beneficial and pathogenic micro-organisms should refer to the review by Fletcher[3].

In the account that follows it can be assumed that, to the best of the author's knowledge, herbicides not listed have not been tested against these particular micro-organisms.

In the testing of the effect of herbicides on soil micro-

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organisms a variety of methods has been used. These include: (a) The incorporation of the herbicide into agar and the growing of a series of known soil micro-organisms on the agar. This method is useful for comparing the resistance or susceptibility of various organisms but the results may bear no relevance to what happens in the soil. In general much higher concentrations of herbicide are required in the soil than in agar to produce similar effects. (b) The measurement of $CO_2$ output or $O_2$ intake of a treated soil using the Warburg technique. This gives a measure of the overall effect on biological activity but does not distinguish between the reaction of various organisms making up the population of the soil. (c) The addition of herbicides to the soil and the subsequent isolation of micro-organisms from it. This has the limitations of all soil isolation techniques. For more specialised investigations. (d) The percolation technique by means of which the herbicide is passed continuously through a column of soil. Samples of the percolating fluid are drawn off at intervals and tested for ammonia, nitrite and nitrate thus giving a measure of the nitrification process. (e) The Winogradsky mud plaque technique which is sometimes used for testing the effect of herbicides on *Azotobacter* in soil. The wetted soil is enriched with carbohydrates and spread on a petri dish. If *Azotobacter* organisms are present in, or have been added to, the soil, they appear after incubation of the soil as colonies on the surface of the plaques. By incorporating a herbicide into the soil it is possible to determine the effect on the growth of *Azotobacter*.

Different workers have thus used different techniques and the apparent discrepancies that occur between one investigation and another may be due in part to these different techniques. Environmental factors, e.g. type of soil, will also, of course, play an important part and it should be remembered that the micro-organisms in themselves are variable; two strains of a given species may react quite differently to any given herbicides.

#### Herbicides and Micro-organisms

AMINOTRIAZOLE (ATA)—By measuring the carbon dioxide output of a silt loam and of a silt-clay loam treated with ATA, it has been shown that, at the levels normally recommended for field application, the chemical has little or no harmful effect on the soil micro-organisms[4]. Alexander[5] reached a similar conclusion and further showed that only at concentrations about one hundred times greater than normal field application rate did any significant toxicity become evident.

Although the overall effect may remain almost unchanged, the nitrifying bacteria appear to be sensitive to ATA; 2-4 lb. per acre inhibited nitrate formation for 14 days in a soil to which ammonium phosphate had been added and thus, for this period, led to an appreciable ammonium-nitrogen concentration in the soil[6].

CDEA AND CDAA—CDEA applied at 6, 24 and 96 lb. per acre has a stimulatory effect on the $CO_2$-evolution of soil but is inhibitive to nitrate accumulation; 96 lb. per acre essentially prohibited it altogether till near the end of the experiment which lasted for 64 days[7]. This concentration is much higher than would be used agriculturally but even 6 lb. per acre (which is the rate normally used) suppressed nitrate accumulation for a period. The magnitude of the effect is probably not great enough, however, to prohibit use of CDEA, and accumulation was affected to a lesser extent during the second half of the incubation period. Rather similar results have been reported for CDAA. Rates of 4-8 lb. per acre reduced the nitrate-nitrogen value at the end of a 14 day period but further samples showed that, at these levels, there was no lasting effect on nitrification[6].

CIPC (CHLOROPROPHAM)— CIPC has a generally stimulatory effect on the soil micro-flora[8], and, although the nitrifying bacteria are much more sensitive than the general population, there is little or no detrimental effect on soil nitrification at the rates used in agricultural practice[9]. In soil treated with 6, 24 and 96 lb. per acre it was found that, although all concentrations were somewhat inhibitive to nitrate accumulation, there was an overall increase in nitrates in the last 32 days of the experiment which ran for a period totalling 64 days[7].

DALAPON—Dalapon has a stimulatory effect on the general soil population[10] at rates up to, and possibly beyond, 68 lb. per acre[11]. The nitrifying bacteria are more susceptible than is the general soil population[12], there being an initial depressing effect at 20-40 lb. per acret, but the depression is temporary[11] and it is concluded that Dalapon, at recommended rates of application, has no harmful effect on the nitrifying bacteria. *Azotobacter* is very resistant; the levels used in field application are so small in comparison with the levels found to inhibit respiration that there is little possibility of danger to *Azotobacter* in the use of these herbicides[13]. Regarding symbiotic nitrogen-fixing bacteria it has been found that rates up to 68 lb. per acre have no effect on the nodulation of soya beans[11].

DINOSEB—Dinoseb is fairly toxic to soil micro-organisms. Soil samples taken from the 0-1 in. horizon of field plots treated with 3 lb. per acre of the chemical showed that inhibition of respiration was still evident three months after treatment[14]. There is some difference of opinion regarding its effect on nitrification, one worker[12] reporting that nitrification is inhibited in the presence of low concentrations whilst another[9], although finding that Dinoseb partially inhibited respiration, concluded that there was little or no detrimental effect on soil nitrification at recommended rates of application. At normal rates the chemical does not harm *Azotobacter*[1].

DNOC—Some workers have reported that, although there may be an initial decrease in numbers of soil micro-

organisms following treatment, this decrease is soon followed by a rapid increase[15]. Jensen and Petersen[16] treated soil with the concentrations used in weedkilling practice and, although they found no quantitative changes in the soil micro-flora, they consider that some risk may attend the continued use of DNOC. Fairly low concentrations of DNOC can inhibit nitrification[12]; but *Azotobacter* is much more tolerant of the chemical[17]. Experiments on the effect of DNOC on rhizobia show that different species vary in their susceptibility[16] but none of them is likely to be harmed by the concentrations used in agriculture.

MALEIC HYDRAZIDE—Maleic hydrazide does not appear to be toxic to soil micro-organisms and it has been shown that repeated applications in concentrations much higher than the recommended field application rates stimulate the soil micro-flora[13]. At low concentra- it appears to have a fertilizing effect in some soils[18]. *Azotobacter* is quite resistant to fairly high concentrations of the chemical[19]. Certain strains of rhizobia are among the most sensitive organisms tested, there being considerable variation even within any one genus[20], but none is likely to be affected by agricultural levels.

MONURON—The findings of most workers are in agreement that, at normal rates of application, Monuron has no adverse effect on the soil micro-flora[19] and similar results have been reported for the closely related compound, Diuron[19]. One group of workers[14], however, report that Monuron applied at 2 lb. per acre may still inhibit the respiratory activity of the soil one month after treatment. Although Hale *et al*[17], using a soil percolation method, were unable to note any effect on nitrification of some 50 ppm (= 25 lb. per acre approximately) Monuron, other workers[20],[12] consider that Monuron is a fairly powerful inhibitor of soil nitrification.

PCP—This has an initial depressing action followed[21] later by a stimulatory effect on the soil micro-flora[22]. The nitrifying bacteria are, however, very susceptible, it being reported that, of a series of herbicides tested against these bacteria, PCP was the most toxic; as low a concentration as 2.5 ppm (= 1 lb. per acre approximately) produced a reduction of respiration[9].

PROPHAM—Soil samples taken from the 0-1 in. horizon of field plots, one and three months after treatment with 20 lb. per acre, showed that there is no reduction in the respiration rates of the soil organisms at either sampling date[14]. Soil nitrification is not affected by rates normally applied in agricultural practice[23].

SUBSTITUTED PHENOXY ACIDS (2,4-D; MCPA; 2,4,5-T; 2,4-DB; MCPB; 2,4,5-TP)—There is general agreement that, at the rates used in agricultural practice, these herbicides have no adverse effect on the general soil micro-population, on the nitrifying bacteria[24], on the growth of *Azotobacter*[1], on the rhizobia[25] nor, in general, on nodulation of legumes[25], although among legumes there have been exceptions; e.g. Payne and Fults[26] noted reduction in nodulation of *Phaseolus vulgaris* at concentrations of 2,4-D in the soil that had no effect on the growth of plants.

SURFACE-ACTIVE AGENTS AND EMULSIFIERS—In the formulation of herbicides an important aspect is the addition of surface-active agents to ensure better retention on the plant. The literature relevant to the formulation of herbicidal sprays contains recommendations for the addition of surface-active agents at concentrations ranging from 1 to 20,000 ppm. As a result of their use in herbicides these substances reach the soil; it is therefore important to determine their effect on soil micro-organisms. The subject has been comprehensively reviewed in recent years[3,27,28]. In general it appears that the ionic surface-active agents inhibit microbial metabolism whereas the non-ionic agents are not toxic. Cationic surface-active agents are more effective inhibitors than anionic agents but the activity of both classes is a function of pH. Cationic agents are equally toxic to gram-positive and gram-negative bacteria whereas the activity of anionic surface-active agents is limited to gram-positive organisms. Experiments[29] have been carried out with Tween 80 (non-ionic), Ceepryn (cationic) and Nacconol NRSF (anionic). Tween 80 has no undesirable effects on the biological activity of the soil and indeed, at concentrations of up to 10,000 ppm, it stimulates $CO_2$ production. 100 and 1000 ppm have no effect on nitrification although nitrification is somewhat reduced at 10,000 ppm. Ceepryn also increases the microbial population although concentrations of 100 and 1000 ppm retarded nitrification in soil. Nacconol NRSF causes increased $CO_2$ production but as little as 100 ppm is enough to retard nitrification and at 1000 ppm nitrification is inhibited completely. It has been suggested that the toxicity of ionic surface-active agents is reduced as a result of adsorption by the colliodal fraction of the soil. The cationic compound was adsorbed to a greater extent than the anionic compound, hence the reason for its apparent lower toxicity.

Results have suggested too that triethanolamine, which is an excellent solvent for herbicides of low solubility, is not an inert solvent as is commonly supposed[30].

The above results indicate that the effect of surface-active agents and solvents should be taken into account when testing the toxicity of herbicidal chemicals or micro-organisms.

TRICHLOROACETIC ACID (TCA)—The effect of TCA on soil micro-organisms follows the pattern for many other herbicides having, at accepted rates for weed control, an initial inhibitive effect[21] followed by a recovery of the soil population[31]. *Azotobacter* is very resistant to this chemical[13] but the nirtifying organisms are more sensitive; Otten[6] found that 20-40 lb. per acre reduced the nitrate-nitrogen accumulation in soil.

**Discussion**

From the above it can be taken that the great majority of herbicides have little effect, as measured by the carbon dioxide output of treated soils, on the mass of soil micro-organisms. It has been noted that, even when there is an initial reduction, this is generally temporary and may shortly be followed by an increase in activity. The increase may be due to the micro-organisms eventually utilising the herbicide as respiratory substrate or to the fact that the organisms originally killed off supply a food reservoir for those organisms which are resistant to the effects of the herbicide. Probably both phenomena take place. Most, if not all, herbicides are selective in their action, some organisms being much more sensitive than others and, although the activity of the soil as a whole may be relatively unaffected, (as measured by $CO_2$ output) the organisms responsible for this production may not be in the same proportions as they were before the herbicide was added.

The nitrifying bacteria appear to be among the most sensitive of the soil micro-organisms towards herbicides and, since they play such an important part in the nitrogen cycle, there must be cause for concern that many herbicides and other biocides are often put on the market without their having been tested against these important organisms. So far, we seem to have been lucky but we may not always be so; and the routine testing of herbicides against a range of soil micro-organisms as part of the preliminary investigation of a compound may well be worthy of study.

No investigation appears to have been made of the effect of herbicides on the denitrifying bacteria which are responsible for the loss of nitrogenous materials from the richer soils.

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## Insect Control in Farm Granaries (*Continued from p. 271*)

each granary has to be considered as a separate entity, with its own particular problems associated with insect control, for each is different in grain capacity, and type of silo, layout, standard of cleanliness and degree and extent of infestation. All these factors, together with the requirements of the farmer, must be considered in arriving at the best solution to the problem of control, the methods for which must be therefore flexible but still conform to the genral procedures outlined above. At the same time, it is obvious that previous experience obtained in dealing with these particular problems is vital, and can enable an expert to achieve a pretty accurate assessment of the results likely to be obtained from varied and various control measures.

One final point deserves emphasis. When grain comes off the fields, it is free of insects likely to infest grain, and so it seems obvious, but vital, that every effort is made to prevent infestation, particularly at this initial point of storage. This is more specially important when it is realised that a much greater proportion of grain is now home grown, this grain being eventually distributed to a number of industries, including flour milling, malting and brewing, provender merchants, and the like, all of whom are otherwise likely to have their premises and stocks of grain infested.

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# CONTACT INSECTICIDES FOR THE CONTROL OF CERTAIN WOOD-BORING INSECTS

**By JEAN M. TAYLOR, B.Sc., M.I.Biol.***

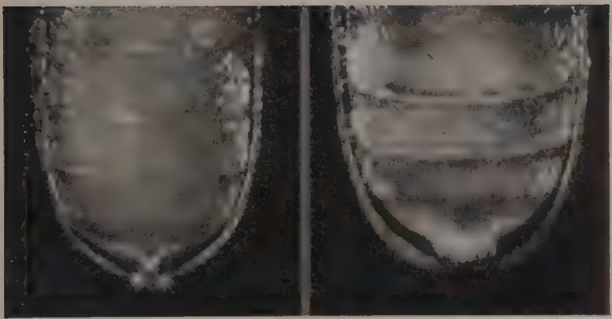
**Contact insecticides have played an important part in international control of insects in recent years. This paper reviews existing information on the use of DDT, BHC, and dieldrin insecticides for prevention or eradication of attack on wood.**

* *Forest Products Research Laboratory, Princes Risborough, England.*

CONTACT insecticides were probably first employed in the control of wood-boring insects for the prevention of attack by *Lyctus brunneus* Steph. in stored hardwoods. The application of 2 per cent DDT emulsion by spraying the sapwood edges of sawn European oak (*Quercus robur*) logs was found to give protection for one emergence season (Forest Prot. Res. Lab., 1949). When applying insecticidal sprays to sawn logs stacked in boule form, good coverage can be achieved since the sapwood edges are exposed. It is more difficult, however, to reach the sapwood of open-piled timber stacks, because the boards in the centre are relatively inaccessible; moreover, the stickers impede the passage of the spray. Tests were therefore extended to investigate the use of fog applicators in treating open piled oake boards, to obtain greater dispersion of the spray and possibly improved coverage of the sapwood. For this purpose 5 per cent DDT emulsion and 1 per cent BHC dispersible powder in water were applied to separate stacks of approximately 500 cu. ft. from one side only, due consideration being given to wind direction. This method of application of water-borne insecticides, however, failed to give sufficient coverage and *Lyctus* attack occurred in both the treated stacks in similar patterns (Fig. 1). The use of an aerosol fog applicator has been recommended, however, for the protection of pallets when dipping is not possible (Johnston, Smith and St. George 1958) by using a mixture of 10 per cent DDT with two per cent lindane in oil solution applied at a rate of ½ gallon/ 100,000 cu. ft. warehouse space, six to eight foggings being recommended at two-weekly intervals throughout the emergence period. The same method of application, using oil solutions of five per cent DDT, two per cent BHC or one per cent dieldrin, was tested by Ossowski (1954) for the treatment of stacked *Eucalyptus saligna* under tarpaulins. Protection of uninfested stacks was obtained for six to eight weeks when treated with DDT or BHC and ten days when treated with dieldrin; further, DDT and BHC killed larvae within infested stacks, but some pupae and adults survived, whereas dieldrin failed to eradicate larvae. Ossowski pointed out that an extension hose is necessary when applying aerosol fogs under tarpaulins to avoid fire risk.

#### Effectiveness of deep treatments

Whereas the application of contact insecticides at the Forest Products Research Laboratory by sprays or as an aerosol fog afforded limited protection against *Lyctus* attack, dip treatments proved to be more effective. Tests carried out by dipping boards for ten seconds in emulsions of DDT at two and one per cent or in BHC or dieldrin at one and 0.5 per cent showed that all these treatments gave effective protection for three years when boards were stored out-of-doors (Taylor, 1960). Similar



*Secondary sex characters* Lyctus Brunneus *Steph. Setae on last visible abdominal sternite converge to a point in female; form a fringe in male.*

tests in America using 5 per cent DDT or 0.5 per cent BHC emulsions applied as ten second dips to green lumber have given protection against *Lyctus* attack for six years; moreover, oil solutions of three per cent DDT or 0.5 per cent gamma BHC protected dry lumber for seven years (U.S. Dept. Ag., 1955).

For eradication of existing infestations, penetration of the timber is required, and oil solvents are generally used. The effect of adding 2.5 per cent DDT to a number of oil preparations or solvents was investigated by Smith (1956) who found that the addition of DDT did not enhance the degree of control obtained by the best preparations, but only increased the efficiency of the least effective materials. Increasing the number of brush coats applied with all preparations from one to three measurably increased the degree of control obtained with both the most effective and fairly effective preparations irrespective of the presence of DDT. These materials were applied to the flat surface of half-round branch wood, 1½ to 3 in. in diameter, ten months after infestation by *L. planicollis*. Similar branch wood was successfully treated 2½ months after infestation by complete immersion in 0.5 per cent dieldrin emulsion for two hours; emergence took place from material immersed in the inert ingredients of the emulsion, though less than from those immersed in water which gave the same number of exit holes as untreated controls (Wright, 1949).

Whereas the use of contact insecticides in timber yards and storage premises has greatly reduced the risk of *Lyctus* attack in solid hardwood furniture and joinery, a fresh problem has developed more recently with the manufacture of plywood from tropical plywoods such as obeche (*Triplochiton scleroxylon*) or afara (*Terminalia superba*), Synthetic glues do not deter *Lyctus* attack and although beetles may cross the glue-line to emerge, larvae rarely do so, being normally confined to one veneer. Consequently, veneers less than ⅛ in. will not usually support infestation unless the plywood is close piled, when the top and bottom veneers of adjacent boards together provide sufficient thickness for the larvae to bore. Such plywood may be protected from attack during storage by spraying the bundles with emulsions of DDT or BHC (Chatterjee, 1953). More permanent protection may be afforded by the addition of insecticides to the glue (Tamblyn and Gordon, 1950). The addition of 0.22, or 0.44 or 0.88 lb. gamma BHC or DDT per 1,000 sq. ft. single glue-line of casein or urea glues prevented attack by *Lyctus* for twelve years, except for the lowest concentration of DDT which failed after five years (C.S.I.R.O., 1953 and 1959). Since BHC is incompatible with P.F. glues, some manufacturers are including dieldrin in plywood made up with this glue, but no published information is at present available on the efficacy of this method of protection (see "Prevention and Control of *Anobium* Attack" below). An alternative method of protecting plywood from insect attack is by treating veneers before the adhesive is added, but contact insecticides have not been tested in this process since suitable protection can be obtained by the addition of these materials during the mixing of the glue.

Few tests have been undertaken with contact insecticides as preservatives against attack by this insect. However it has been stated (NZ For. Serv., 1960) that long term trials in New Zealand on the effectiveness of various materials for prevention of infestation by *Anobium* have included DDT, dieldrin and lindane. Of these materials, only DDT has failed at 0.2 per cent after ten years.

Results obtained by Becker (1953) using the larval transfer technique with partly grown *Anobium* larvae indicate a low toxicity for DDT. He found that the loading required to give 100 per cent kill after twelve weeks was DDT 4000 g/m$^3$ (0.25 lb./cu. ft.), BHC 70 g/m$^3$ (0.004 lb./cu. ft.) and dieldrin 1500 g/m$^3$ (0.09 lb./cu. ft.). This gives a loading ratio of 1:20 between the effect of BHC and dieldrin, respectively, which may be due to the fumigant action of BHC within the confined spaces of the drilled holes into which the larvae were inserted.

Spiller (1952) found that a single brush treatment with five per cent DDT or two per cent BHC completely prevented emergence from infested ¾ to 1 in. rimu (*Dacrydium cupressinum*) and kahakatea (*Podocarpus dacrydioides*) boards during the emergence period approximately one month after treatment. Some emergence took place during the following two years but the numbers of beetles were very low when compared with other treatments.

In tests at this Laboratory, single brush treatments of a number of oil-borne insecticides applied to infested ½ in. plywood in May 1957 were found to give complete control during the emergence season of that year. The same degree of control was produced with solvent alone (white spirit) and with paraffin. During the following

two years, however, some emergence took place from surviving larvae in all treated boards except those brushed with 0.5 per cent dieldrin and one of the two boards treated with 0.5 per cent BHC. No further observations were conducted since the boards were caged separately and in consequence there was no possibility of re-infestation from outside sources.

Tests are in progress in New Zealand for the protection of plywood by the addition of dieldrin to casein, U.F. and P.F. resins at rates between 0.025 and 4.0 per cent glue weight (Rep. D.S.I.R. N.Z., 1959). This material was exposed to attack in 1954/5 and subsequent years, but only the untreated controls have become infested. Although this experiment is still in its early stages, it has been recommended to manufacturers to include dieldrin at the rate of 0.3 per cent of prepared glue weight in plywood and at 0.15 lb/cu. ft. of particle board to prevent attack. It is interesting to note that in the United Kingdom, however, there has been no record of attack by *Anobium* in plywood made with synthetic resin.

**TABLE 1**

*Effect of insecticidal smokes on subsequent emergence of Anobium punctatum*

| Insecticide | 1957 | 1958 |
|---|---|---|
| Lindane/DDT | Beetles emerged and laid viable eggs | Beetles emerged and laid viable eggs |
| Lindane/dieldrin | Fewer beetles than above; no eggs laid | ,, ,, |
| Gammexane | ,, | ,, |

Room capacity—770 cu. ft. Date of treatment—July 10-15, 1957.

Generator capacity—1000 cu. ft. Emergence of beetles: July-August

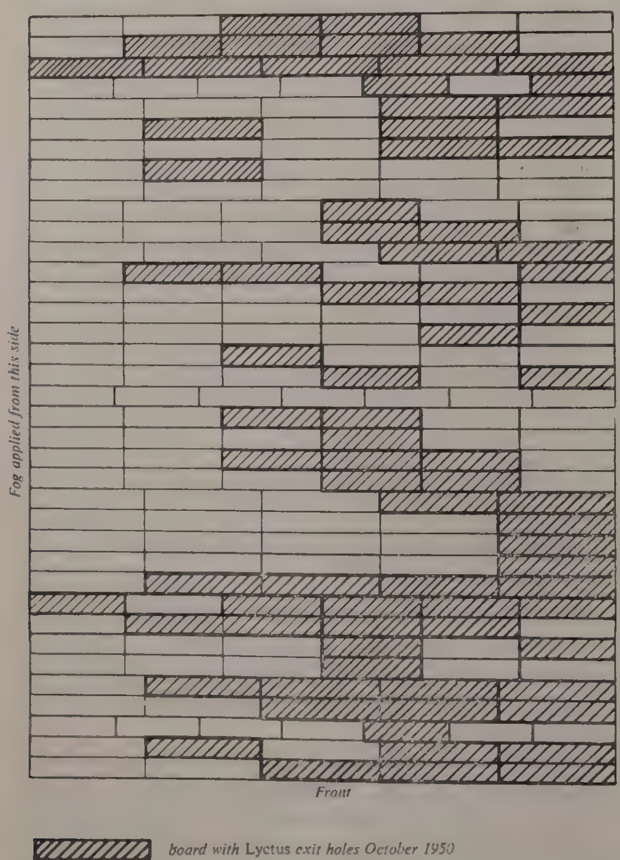



*Fig. 1. Effect of insecticidal smokes on subsequent emergence of* Anobium punctatum.

The use of insecticidal smokes for the control of the common furniture beetle has been investigated at this Laboratory and the results have shown that deposits obtained were greatest on the horizontal upper surfaces (floor) least on the horizontal lower surfaces (ceiling), and intermediate on vertical surfaces (walls). Increasing the dosage did not proportionately increase the deposit on the horizontal lower surfaces. All beetles in the room at the time of treatment were killed, but there was no appreciable effect on the larvae within infested wood. It was found, however, that the deposit obtained affected egg-laying in beetles which subsequently emerged from infested plywood which had been hung vertically in the room during treatment (see Table 1).

Although the effect of insecticidal smokes is transient, they might be used as a temporary control measure during the emergence season in order to reduce the risk of spread of infestation until more thorough treatment can be carried out.

This insect presents special problems when treating infested timbers, owing to their large dimensions and the association of attack with old fungal decay (often internal). Tests carried out with decayed oak sapwood dipped for ten seconds in a number of solutions have shown that three years after treatment 0.5 per cent dieldrin or 0.5 per cent gamma BHC in white spirit did not prevent egg-laying, but eggs either failed to hatch or larvae died on hatching.

In order to investigate the action of dieldrin and gamma BHC (lindane) deposits, a series of test (out-of-doors, under cover) were undertaken in which beetles were confined on treated filter papers for limited periods and then transferred to egg-laying blocks. Filter papers were used in preference to wood in order to minimise variability of the substrate, and solutions were applied by means of a pipette traced spirally from the outer edge of the paper to the centre, 0.25 ml. being used in each case. The concentration of the treating solution was varied to give the required deposits, the solvent being white spirit.

Death-watch beetles were obtained daily from the floors of infested buildings and had probably already laid some of their eggs; however, a proportion of these beetles was always used an untreated controls. Furniture beetles were collected daily from stocks of infested plywood stored in out-door insectaries. The effects of

**TABLE 2**

*Eggs laid by Anobium punctatum after exposure to treated surfaces (3 papers per concentration; 5 pairs of beetles per paper)*

| Insecticide | Deposit (Mg /sq cm ) | Deposit 1 day old | | | | Deposit 2 week old | |
|---|---|---|---|---|---|---|---|
| | | Expos for ½ hr | | Expos for 3 hr | | Expos for 3 hr | |
| | | No. eggs | Percent hatched | No. eggs | Percent hatched | No. eggs | Percent hatched |
| Dieldrin | 0 04 | 4 | 100 | 0 | — | 0 | — |
| | 0 02 | 19 | 100 | 28 | 82 | 22 | 100 |
| | 0 004 | 16 | 100 | 29 | 89 | 62 | 76 |
| Control | Nil | 124 | 88 | 124 | 88 | 94 | 76 |
| Lindane | 0 04 | 0 | — | 0 | — | 116 | 89 |
| | 0 02 | 0 | — | 0 | — | 215 | 89 |
| | 0 004 | 78 | 63 | 0 | — | 135 | 82 |
| Control | Nil | 108 | 96 | 119 | 94 | 161 | 69 |

the insecticides on the beetles, their length of life and egg-laying were recorded.

When beetles were exposed to dieldrin or lindane they became "affected" some time before death. During this phase co-ordinated movement was lost and beetles either walked in a jerky manner or lay on their backs being unable to remain on their feet when turned over. The tests carried out have shown that after exposure to deposits of lindane or dieldrin, although death did not follow for some time, egg-laying was prevented or greatly reduced, once beetles became affected.

It will be seen in Fig. 2 that *Anobium punctatum* beetles are affected more quickly by lindane than by dieldrin, and in Table 2 it is shown that there was no egg-laying when affected beetles were transferred to untreated blocks after their period of exposure. With dieldrin, however, the effect was only marked at the highest concentration, viz. 0.04 mg./sq. cm. for three hours. This effect in the case of dieldrin was retained for the period of the test (two weeks) whereas the filter papers treated with lindane were no longer effective at that time. The duration of deposits on filter papers, however, are not equivalent to those on wood. Table 3 shows that an exposure period of 15 minutes was sufficient to prevent egg-laying by beetles confined on filter papers with lindane deposits of 0.02 mg./sq. cm., whereas a five-minute exposure failed; egg-laying was reduced in beetles confined on equal deposits of dieldrin for similar periods of time, but in no case was it completely prevented.

Similar tests were carried out using the death-watch beetle *X. rufovillosum* and it was found that much longer exposure periods were necessary before the beetles became affected and egg-laying prevented (Table 4). This may be due to the fact that this species is very lethargic and in consequence may not pick up as much insecticide as the more active common furniture beetle.

From Fig. 3 it will be seen that when beetles were confined on the highest deposit of dieldrin until dead, only 20 per cent were affected after one day, 60 per cent after two days and 85 per cent after three days.

After an exposure period of 24 hours, therefore, insufficient insecticide had been picked up by the beetles to prevent egg-laying when transferred to untreated wood.

With lindane an exposure period of 24 hours on deposits of 0.04 mg./sq. cm. was necessary to prevent

**TABLE 3**

*Eggs laid by Anobium punctatum after exposure to deposits of 0.02 mg./sq. cm. for different periods of time.*

| Exposure period | Dieldrin | | Lindane | |
|---|---|---|---|---|
| | No. eggs | Percent hatched | No. eggs | Percent hatched |
| 5 min. | Not tested | | 73 | 86 |
| 15 min. | 72 | 96 | 0 | — |
| 30 min. | 36 | 78 | 0 | — |
| 60 min. | 19 | 95 | 0 | — |
| 2 hr. | 14 | 79 | Not tested | |
| U/C | 203 | 98 | 303 | 96 |

**TABLE 4**

*Eggs laid by Xestobium rufovillosum after 24 hr. exposure to treated surfaces. (5 papers per concentration; 10 beetles per paper).*

| Insecticide | Deposit (mg./sq. cm.) | Female beetles | Total eggs laid | Eggs per female | Percent eggs hatched |
|---|---|---|---|---|---|
| Dieldrin | 0.04 | 39 | 82 | 2.1 | 74 |
| | 0.02 | 34 | 47 | 1.4 | 55 |
| | 0.004 | 34 | 62 | 1.8 | 48 |
| Control | Nil | 39 | 205 | 5.3 | 55 |
| Lindane | 0.04 | 37 | 0 | 0 | — |
| | 0.02 | 44 | 11 | 0.25 | 0 |
| | 0.004 | 35 | 187 | 5.3 | 66 |
| Control | Nil | 44 | 161 | 3.7 | 53 |

At the time of these tests the sex of *X. rufovillosum* had to be determined after death. More recently secondary sex characters have been described (Harris, 1960).

egg-laying, although egg-laying was greatly reduced after the same exposure to deposits of 0.02 mg./sq. cm.

These tests have shown that exposure to lindane or dieldrin deposits may not result in the rapid mortality of *Anobium or Xestobium* adults, yet if sufficient insecticide is picked up to affect these insects, egg laying may be completely prevented. Lindane has a greater initial effect than similar deposits and exposure periods of dieldrin.

The preservative effect of dieldrin against the house longhorn beetle was investigated by Durr (1951). Retention of 0.013 lb/cu. ft. obtained by soaking $1 \times 1 \times \frac{1}{2}$ in. blocks of *Pinus pinaster* for 30 minutes in a solution of 0.257 per cent dieldrin in white spirit was sufficient to prevent survival of inserted larvae after 28 weeks; further tests with *Hylotrupes* inserted in blocks four years after soaking in five per cent BHC showed the treatment was still effective (Durr, 1954).

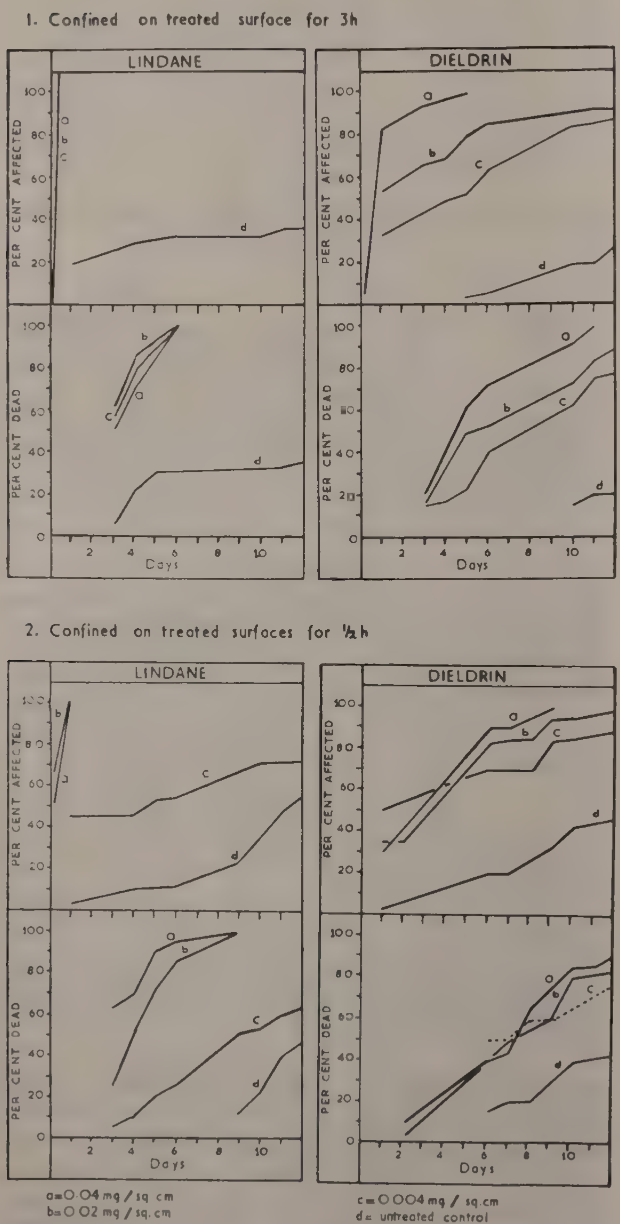



*Fig. 2. Effect of lindane and dieldrin on* Anobium punctatum *beetles.*

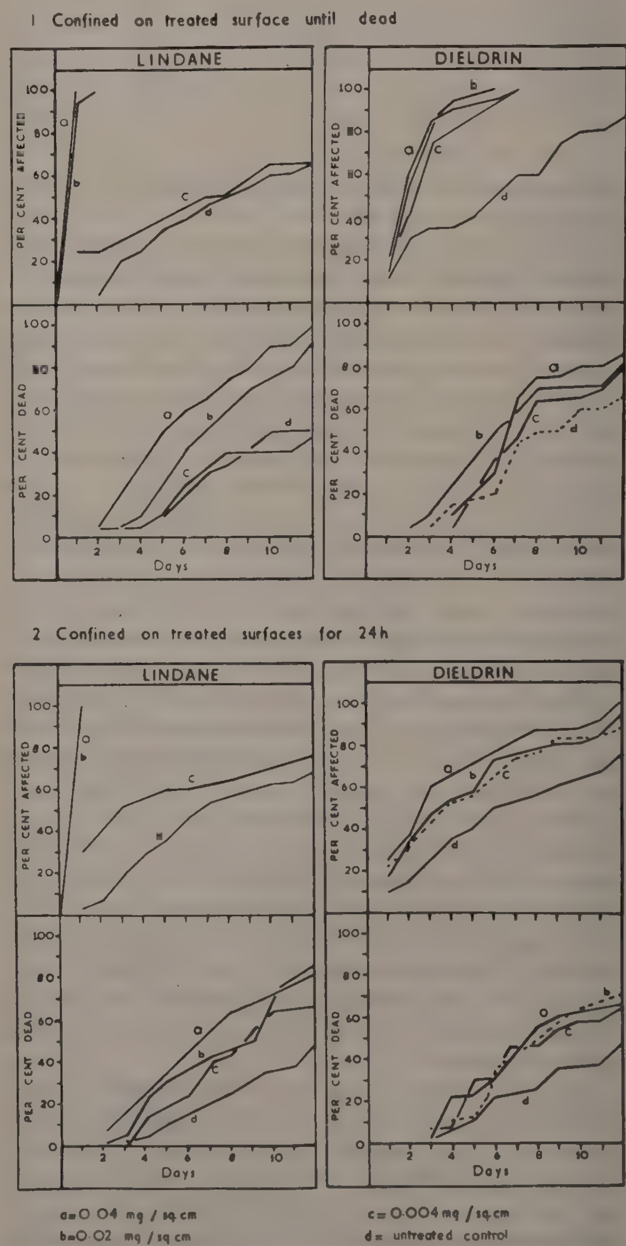



*Fig. 3. Effect of lindane and dieldrin on* Xestobium rufovillosum *beetles.*

In tests in Germany, Becker (1953) found the minimum retention of insecticide necessary to kill 100 per cent newly hatched *Hylotrupes* larvae inserted into impregnated blocks to be 0.5 $g/m^3$ (0.03 lb/1,000 cu. ft.) when four weeks were allowed to elapse before the blocks were examined, and 0.1 $g/m^3$ (0.006 lb/1,000 cu. ft.) when the exposure period was extended to twelve weeks in the case of dieldrin. The corresponding figures for gamma BHC are 2 and $< 0.03$ $g/m^3$ (0.12 and $< 0.002$ lb/1,000 cu. ft.) and for DDT, 15 and 1.5 $g/m^3$ (0.9 and 0.09 lb/1,000 cu. ft.). These figures are very much below those required for medium sized *Anobium* larvae, particularly in the case of DDT and dieldrin.

The eradication of larvae from infested wood has been achieved by the application of oil or kerosene solutions of 0.5 per cent gamma BHC or five per cent DDT by brushing the surfaces of infested timber or by pouring the insecticides into drilled holes ½ in. in diameter, 1 ft. apart and three-quarters of the way through the timber, or by injecting with a pressure gun into holes of smaller diameter. (St. George, Johnston and McIntyre, 1957). These results were confirmed when the floor joists and sub-flooring of infested houses were brushed with five per cent DDT, 0.25 per cent dieldrin or 0.5 per cent lindane oil solutions at a rate of 1½ pints per cu. ft. or with a pressure gun when two to five times this rate was achieved (U.S. Dept. Ag., For. Serv., 1956 and 1958). It was noted that relatively sound wood was more difficult to treat than when severe infestations were present.

#### Conclusions

The value of contact insecticides for the control of *Lyctus, Anobium and Hylotrupes* is fairly well established. The problem of the prevention of attack by *Lyctus* in stored hardwoods has been greatly reduced in this country by the use of these insecticides, and the addition of BHC or dieldrin to the glue-line is a promising method of protecting plywood from attack.

More work is required on the use of contact insecticides for the control of *Anobium* and *Hylotrupes*, but the information available indicates that their inclusion in materials for eradication is of value, and that they are likely to remain effective for some years in treated wood. It is possible that they may be of use in the protection of plywood against furniture beetle attack, but more tests are needed, particularly with susceptible birch/alder interior grade plywood made up with glues of natural origin.

The action of BHC and dieldrin on beetles is such that they are not killed directly, but may quickly become "affected" and during this stage egg-laying ceases or may be greatly reduced. Beetles are more quickly affected by BHC than by dieldrin. The death-watch beetle is less susceptible to the effect of contact insecticides than the common furniture beetle, probably owing to its lack of activity.

Whereas emulsions are suitable for surface treatments for relatively short term protection, oil solutions are likely to give better penetration for eradication of existing infestations or for longer protection. Insecticidal smokes may be used for short-term prevention of spread of infestation, but treatment must be repeated annually at the onset of the emergence period.

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*This article formed the basis of a paper given by the author at the recent conference of the British Wood Preserving Association at Cambridge.*

# NEWS

research: events: products:

## Cotton insecticide airlift to Egypt

The Egyptian government has ordered more than two million pounds of Sevin insecticide, at a cost of more than two million dollars, in an attempt to save the Egyptian cotton crop. Exported from the U.S.A. by Union Carbide International, it is to combat an invasion of armyworms on the march through Egypt, according to company officials, who have been sending emergency shipments of the product by air.

The worm pests threaten to wipe out Egyptian crops by devouring any fields that happen to be in their path.

Union Carbide said orders of Sevin insecticide planned by Egypt could run the air shipments as high as five million pounds. The first KLM Dutch freighter last month carried nearly 34,000 lb. of Sevin insecticide, packed as a powder, in 570 barrels. It is mixed into a spray for use in Egypt to quell the armyworm infestation and to control other cotton pests.

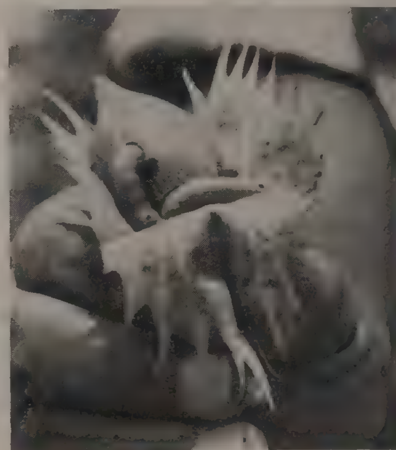
Purchase of Sevin insecticide from Union Carbide by the Egyptian government is described by the company as an encouraging example of co-operation between the Middle East and the United States in the areas of agricultural science and business.

The insecticide order was placed early in August. An earlier exchange of information between U.S. and Egyptian agricultural researchers developed interest in new Sevin insecticide, which has been applied in cotton-growing regions of America during the past two years. This spring, the U.S. government and Union Carbide sponsored exhibits at the mammoth International Agricultural Exposition at Cairo. Interest was heightened in the use of the new compound to help protect Egyptian crops from insect attack.

Known as Seffein in Egypt, the insecticide will be used extensively to control insects on cotton, maize, barssim and other crops.

Sevin is claimed to be lower in toxicity to humans and warm-blooded animals than are most insecticides, but to be extremely effective in controlling a wide range of insects on many crops. The safety of Sevin insecticide is important in Egypt because most pesticides usually are applied by hand-operated sprayers. Masks or protective clothes are rarely worn.

During the armyworm plague, the insecticide is being applied by both aerial and ground equipment.



Prodenia litura, *a type of armyworm, feeding on Egyptian cotton boll.*

## Wood preserving plant in Tanganyika

A factory for the production of wood preservatives, insecticides and chemicals for wood-destroying fungi may be built in Tanganyika by the Rentokil group of companies, according to a representative of the group, Mr. E. H. B. Brooke-Boulton, speaking recently in Dar es Salaam to an audience of architects, builders and contractors.

He said the group's plans for the size and scope of a factory in Tanganyika must depend on the needs and potential scope in the country for timber preservation and treatment, and reminded his audience that concrete and steel were widely used in that country, instead of the local and cheaper timber.

According to a spokesman of the forest division of the Ministry of Lands and Surveys, it is impossible in a country like Tanganyika which suffers from large-scale damage from termites and other insects and fungi to overestimate the importance of extending the use of preservatives for timber. Wood preservation facilities already exist in the country, but the problem is said to be to convince the user of timber that it is false economy to use untreated wood.

## Brazzaville conference of parasitologists

A meeting of specialists on ankylostomiasis took place in Brazzaville last month, organised jointly by the Commission for Technical Co-operation in Africa South of the Sahara and the World Health Organisation. About fifteen specialists in this field, mainly physicians and parasitologists, were due to attend.

It is known that ankylostomiasis in certain areas of Africa affects a very large part of the population. More than 95 per cent of the inhabitants in certain cases house these parasites which come from water and poor hygiene.

The meeting was called to study the factors which the development of ankylostomiasis and other parasites, i.e. temperature, rainfall, etc., reviewing the different types that are known, and to discuss methods of treatment and prevention.

An inter-governmental meeting is scheduled to take place in Dakar in September to discuss in general problems of housing and hygiene.

## Product for the control of fruit fungi

"An original and valuable contribution by the chemical industry to the range of agricultural pesticides."

This was how Dr. Walter F. Jepson, a Cyanamid International expert on agricultural chemicals, described Melprex, a new fungicide, when he addressed the Society of Chemical Industry at a symposium in London recently.

Trials had established that Melprex or dodine ("the accepted generic name for the chemical") showed "excellent effectiveness in controlling certain fungus diseases attacking deciduous fruit", said Dr. Jepson.

Melprex was a guanidine derivative, one of a number that had been the subject of trials over the past five years. It was now available commercially for the first time in this country under the brand name of Melprex but had been marketed for some two years in the U.S.A. as Cyprex.

Among the findings reported by Dr. Jepson were that the chemical (1) had excellent spreading and adhesive properties, giving long persistence on foliage, and resistance to rain, (2) was outstanding against scab disease, (3) had shown good results on black spot disease of roses, (4) had a curative as well as a protectant action, (5) did not encourage mildew, and (6) on long-lasting effects, and low human toxicity, had the same advantages of other fungicides already accepted by fruit growers everywhere.

He said that the product was also recommended to control black spot of roses.

## Electrically operated dispenser for fly control

Latest contribution to fly control techniques comes from Disinfestation Ltd., of London, in the form of the Synchromist electrically operated dispenser.

This cabinet, which is less than 1 ft. square and only a few inches deep, emits a measured quantity of concentrated pyrethrum aerosol at regular 15 minute intervals. It therefore provides continuous control.

Because it is non-toxic to humans and domestic animals and non-tainting to foodstuffs, the Synchromist can be used in any establishment troubled with flies, i.e. food and tobacco factories, dairies, kitchens and restaurants.

One unit will treat a room having a capacity of up to 6,000 cu. ft. There is claimed to be a 100 per cent. "knockdown" of flies in the space of 15 minutes, provided there are no strong air currents in the room.

The concentrated pyrethrum insecticide is contained in a replaceable 12 oz. aerosol, and one aerosol container will last 34 days running continuously, 68 days of working 12 hours a day, or correspondingly longer if working 8 hours a day.

The Synchromist is designed to operate on a 200-250 volt, 50 cycle a.c. mains supply. It is simply mounted on a shelf or wall at least 6 ft. from the ground in an unobstructed position.

The unit may, if required, be supplied on a service basis, the manufacturer replacing the insecticide and checking operation.

## One-gallon spray unit with hand pump

A new, labour-saving spraying device has been developed by Testar & Swain Ltd., of Birmingham, and produced in conjunction with Cascelloid, of Leicester who manufacture the 1 gallon high density polythene container.

It consists of a strong plastic bottle with a hand-pump, six feet of p.v.c. tubing leading to an angled 20 in. lance of nickel plated brass, and a patented adjustable nozzle with a shut-off, fine spray, coarse spray and jet.

All that is necessary is to fill the container with the spraying liquid, give the hand-pump a few strokes, and then carry on spraying.

Called the Sovereign Compression Killasprayer, it is guaranteed fully by Testar & Swain.

### Diphenyl mercury production

After intensive research into organic compounds of mercury, F. W. Berk & Co. Ltd., of London, announce that they have developed a simple and direct process for the commercial production of diphenyl mercury. They say that this product is now available in commercial quantities at a radically reduced price. The product is a white micro-crystalline powder, containing about 56.5 per cent of mercury, which melts at 125-126°C.

The Berk method of manufacture is capable of adaptation for in situ synthesis of diphenyl mercury, and methods of treating timber and textiles to give a built-in resistance to fungicidal attack are in procees of development. Although in such treatments aqueous solutions are used, the active fungicide in precipitated within the fibres of the textile, and being insoluble in water, is non-leachable. Initial results from toxicity tests are reported to indicate that this process has a relatively low toxic hazard.

## New technique for preserving timber

The secret of successful wood preservation is to get an adequate amount of preservative deep into the wood. An original technique of achieving this and using a new preservative formulation called Woodtreat was developed and patented in the U.S.A. After two years' research and testing, the product is now being manufactured in Britain by Preservation Developments Ltd.

Woodtreat consists essentially of an organic solvent preservative made into the form of a "mayonnaise-type" emulsion. This thick, gelled emulsion is applied to the surface of the timber as an overall coating or as suitably spaced bands or ribbons, providing a reservoir from which the preservative is gradually released and absorbed by the timber. The manufacturers describe this as a method of soaking timber without the use of soaking tanks.

*Ribbons of Woodtreat applied across the grain to oak joists and ceiling boards*

It is said to give higher retentions and deeper and more even penetration than brushing or spraying with conventional organic solvent type preservatives. Work carried out in the U.S.A. using chemical analysis is said to have shown that application of a single $\frac{1}{4}$ in. layer of Woodtreat to the service of timber is better than the application of twenty brush coats of organic solvent type preservatives. Work carried out in the U.K. by Preservation Developments using tracer dyes is said to have shown that Woodtreat will even penetrate the extremely resistant heartwood of oak over 600 years old.

The first paper about Woodtreat in the U.K. was published in PEST TECHNOLOGY in July 1960 and summarised the results of American and British research.

Woodtreat-55, now being produced in London, contains pentachlorophenol and dieldrin, and is therefore highly effective against fungi, wood-boring insects and termites.

Because the product enables timbers in situ to be impregnated in force and in depth, the manufacturers envisage that its most obvious use is for eradication of woodworm, termites, dry rot and other forms of decay. Its penetrating properties enable the preservative to reach insects and fungi within the timber. It is already being used by several leading curative treatment com-
leading curative treatment companies, and has been used on a number of important public buildings, historic churches and large country houses.

Preservation Developments say that Woodtreat should not be used for treating wood of small cross-section such as panelling, floor boards or laths, which are more readily treated by spraying. Work so far has been concentrated on curative treatment of timber in buildings, but the makers say that its other applications include the treatment of the ends of joists and rafters in new buildings, glulam timbers, areas exposed by cutting or boring, ground line treatment of transmission poles and wood in boats.

Woodtreat-55 is packed in open-topped drums holding 56 lb. Rate of application is normally 1-2 lb. per cu. ft. of timber. For treatment of end grain joists, the contents of one drum will treat 7000 sq. in.

## Australian battle with phasmatids

The Australian government had recently to take emergency steps to deal with a widespread attack on thousands of acres of timberland by an invasion of winged phasmatids. The stick-like creatures, 4 in. long and somewhat resembling praying mantises, killed not only large eucalyptus trees in their path, but the regenerating undergrowth as well.

Recent tests uncovered as many as 500,000 phasmatids in each acre of badly infested woodland. They posed an immediate hazard to the entire catchment or drainage basin of the £A40 million hydroelectric project in the Kiewa Valley, Victoria, and threatened rapid expansion through the State.

A preliminary survey indicated that the danger area extended over 6,000 acres, at least 600 of them already devastated. The government put into action a helicopter unit equipped with a special malathion spray developed by Cyanamid International. The helicopter was more suitable for operating in the rugged terrain than a light aircraft.

The formula used by the team was $5\frac{1}{2}$ oz. of malathion mixed in 3 gal. of BP diesel oil, applied to each acre of forest at tree-top level. While final assessments of its effectiveness in the entire valley are still being made, preliminary indications are that the operation proved successful. In an experimental area of 30 acres, the formula killed a record 95 per cent of the phasmatids.

The population of the phasmatids is normally kept in check by the wasp parasite, which is little harmed by the short residual action of the malathion.

## New recommendations for seed dressings

Following the agreement between the Association of British Manufacturers of Agricultural Chemicals, other interested organisations and the U.K. Ministry of Agriculture on the use of certain insecticides in seed dressings from the 1st January next, British Schering Ltd. has announced that it will cease to use aldrin in Mist-O-Matic Wireworm liquid dressing and Granadin dual purpose powder dressing for the control of wireworm from that date.

Mist-O-Matic Wireworm liquid dressing based on the pure gamma-isomer of Benzene-hexachloride is now offered at prices identical with those for Mist-O-Matic Aldrin liquid dressing. Mist-O-Matic liquid dressing and Granadin W powder dressing containing this insecticide will still be available, for the autumn control of wheat bulb fly.

In a statement made last month, Mr. H. G. Huckle, general manager of Shell Chemical Co's agricultural division said:

"We very much welcome the statement made in the House of Commons by the Minister of Agriculture that agreement has been reached with the agricultural chemical manufacturers on new recommendations for the use of seed dressings.

"Public attention generally has been very sharply focussed on the whole problem by reports that certain dressings were considered to be responsible for the deaths of birds and other wild life. Manufacturers of agricultural chemicals are very much aware of their responsibility in this matter and I think it is not generally realised that for a long time they have been carrying out a continuous programme of research to find an effective answer. In common with other manufacturers, Shell has devoted a great deal of time and money on their research projects in this field and we were naturally very happy to be the first to announce—a few days ago—a successful outcome to our efforts. I refer to our introduction of Kotol, a liquid seed dressing based on lindane, itself known to be the least hazardous insecticide to birds and other wild life. We are also extremely pleased to see that the new recommendations announced by the Minister fall completely in line with those announced earlier by us for use with our new formulation which I am sure will do much to fulfil the dual purpose of protecting crops from the ravages of wireworm while at the same time providing an insecticide less hazardous to the nation's wild life."

## Dangers of opened pesticide containers

The British Ministry of Agriculture has issued a warning about the dangers of partly used containers of poisonous chemicals to people, livestock, domestic fowls and wild life unless they are properly stored or disposed of safely.

1. Where it is not intended to keep the chemical left in the container for use in another season: (a) empty the unwanted chemical into a hole dug in the ground where it is not likely to be disturbed and where there is no danger of contaminating water supplies. Wash the container out carefully and empty the rinsings into the hole before filling it in; (b) washed out containers should then be either returned to the supplier, if this can be done, burned, if possible, or punctured and buried in a safe place.

2. Full, and partly used containers which are being kept for use next year should be stored under lock and key where there is no risk of contaminating feedingstuffs, seeds or fertilisers, and where neither children nor animals can get at them. Make sure that containers do not leak.

### LETTER TO THE EDITOR

Sir,

We were most interested to read the article in the June issue of PEST TECHNOLOGY, by Dr. H. J. Egglishaw on the Sea-Weed Fly—Coelopa frigida, giving details of the life history of this insect.

We wish, however, to point out what we believe to be an error in his description of the most efficient and simplest way of avoiding a plague of these flies, which, he states, can be undertaken by either removing the sea-weed from the beach, or by carrying the wrack below the high tide line, so that the larvae are either eaten by birds or drowned by the incoming tide.

It is our experience that sea-weed deposited on the South coast of England by South-West gales is soon buried by shingle and under these circumstances it is, of course, impossible to remove it.

Secondly, we doubt whether the removal of exposed sea-weed to a position below the high tide line will necessarily cause the larvae to be drowned.

Under these circumstances, chemical control is the only alternative, and this, in our experience, is best undertaken by the application of Gammexane emusifiable concentrate, (containing 20% gamma BHC), which is diluted at the rate of 1-2 quarts per 1,000 gallons of water, and applied to an acre of shingle beach.

At this high rate of dilution, penetration of insecticide is obtained to the infested sea-weed below the shingle surface, though it may be necessary to make two or three such applications, prior to the commencement of the Summer holiday season.

There is no doubt that this insect has caused extreme nuisance to holiday-makers on the South Coast, and elsewhere, but the use of the above method and material applied by Council Gulley-Emptier has made the application reasonably economic and fully justified the expense in relation to the comfort of holiday-makers.

**E. Ramsay Goodliffe**

*Managing Director, Ratsouris Ltd.,*
*Golden Acre, 50 Central St., London, E.C.1.*

## New film on systematic insecticide

May & Baker Ltd., have produced a new 15 minute, 16mm colour film with sound on the systemic insecticide, 'Dimecron' (phosphamidon).

The film opens with some interesting sequences using time-lapse photography to show dramatically how a systemic insecticide works. The time-lapse technique consists of single frame photographs taken every ten minutes over a total period of 48 hours. When these single frames are run together at the normal cine speed the apparent action is speeded up so that the effects can be shown in a few minutes. Duiing this sequence, caterpillars on the untreated test plant are seen stripping the leaves to a skeleton. On the other hand, the plant treated with 'Dimecron', at a rate equivalent to field spraying conditions, is quite unaffected. The insecticide moves throughout the plant and the caterpillars can be seen dying and falling off as soon as they have eaten any part of the plant. A similar demonstration later on in the film, shows aphids feeding on another test plant and dropping off as the insecticide takes effect.

The following section of the film deals with the use of the systemic insecticide on the farm. It shows how a wide range of pests of top fruit can be controlled with a simplified spray programme and outlines crop inspection and the use of 'Dimecron' to give clean crops and an improved yield in hops and sugar beet.

Arrangements to show the film can be made with the Agricultural Department of May and Baker Ltd. at Dagenham.

## Control of warble fly in British tests

Statutory treatment for the control of warble fly in Britain is to dress the swellings on the backs of the animals with derris and to squeeze out the warble grubs. Three or four dressings have to be given between March (when the warbles begin to show) and May.

Because of practical difficulties of this treatment on many farms, Dow Agrochemicals Ltd., of Kings Lynn, have conducted experiments to control warble fly infestation with new systemic drugs which are administered in the autumn. These organo phosphorous compounds kill the grubs in the animals before they can form the swellings and so prevent any damage to the hide.

At Home Farm, at Middle Aston, Oxen, owned by Spillers Ltd., ten Freisian heifers being reared as dairy replacements were treated with Etrolene and ten were studied as controls. The drugs were administered as a drench on 21st December 1960. Counts were taken on two occasions in April and mid-May. The treated cattle are reported to have shown an average of less than one warble per beast and the untreated over ten.

The company says that Etrolene is the first drug which can be given by mouth as a single dose and will kill insect and other parasites, such as lice, wherever they are in or on the animals' body. In the past six months the administration of Etrolene via the feed has been studied. Six trials have been run, using feed mixed and medicated by three different compounders.

The dosage rate aimed at was 15 mg. of pure drug per kg. of body weight per day for 7 days. The feed was medicated at the rate of 9lbs. of a 40% premix of Etrolene per ton of feed giving a theoretical Etrolene content of 0.16%.

The medicated feed was fed at the rate of 1lb. per live hundred weight per day for seven days.

Another investigation conducted has been the effect of combining Etrolene treatment with another new insecticide, Nankor, which protects the cattle from flies. An emulsion of Nankor was mixed with three parts of diesel and one part of unused engine oil. This was then applied to a back rubber constructed of a length of barbed wire wrapped in sacking and suspended between two uprights at a height just lower than a beast's back. Cattle rapidly learned to rub their backs under the sacking and thus dress themselves with insecticide. This gave them immunity from worrying by flies as well as protection against the warble.

## Weed control talks in London

Representatives of local authorities, British Railways, British Waterways, oil companies, wharfingers and other industries concerned with weed control were entertained recently by Disinfestation Ltd. in London.

The conference demonstrated how weeds could be controlled efficiently and economically for purposes of amenity or reduction of hazards such as fire. There was an exhibition of photographs, equipment and chemicals staged jointly by Disinfestation Ltd., and Chipman Chemical Co. Ltd.

Among the interesting examples of weed control carried out by Disinfestation was a "kerb revealment" treatment on a trunk road; treating growth above underground petrol storage tanks; treatment of electricity sub-station compounds; and treatment of areas round airport taxi-track and landing lights where grass could not be cut by mechanical means.

## Approved chemicals

The following further additional products have been approved for use in the U.K. under the agricultural Chemicals Approved Scheme:

INSECTICIDES

Dieldrin emulsions and miscible liquids: *Profarma Dieldrin* 15% (Profarma Ltd.).

Mecarbam (an organo-phosphorus insecticide and acaricide for use on apples and pears to control the active stages of red spider mite, and certain aphids and pear sucker): *Murfotox Liquid* 80% (Murphy Chemical Co. Ltd.).

BHC—wettable powders: *Bugges BHC Dispersible Powder 50% (6-5% gamma)* (Bugges Insecticides Ltd.).

FUNGICIDES

Captan sprays: *Orthocide Garden Fungicide* (Murphy Chemical Co. Ltd.).

Maneb wettable powders: *Unicrop Maneb* (Universal Crop Protection Ltd.).

Quintozene (PCNB) dusts: *Murphy PCNB Dust* (Murphy Chemical Co. Ltd.).

Thiram sprays: *Murphy Thiram* (Murphy Chemical Co. Ltd.).

Organo-mercury foliage/sprays: *PP Liquid Mercury Plus* (Plant Protection Ltd.).

Zineb-wettable powders: *Unicrop Zineb* (Universal Crop Protection Ltd.).

HERBICIDES

MCPA alkali metal salt sprays: *Nickerson's Gamesafe* (E. W. Nickerson & Sons Ltd.); *Verdone* (Plant Protection Ltd.).

MISCELLANEOUS

Wetters: *P.B.I. Wetter* (Pan Britannia Industries Ltd.).

## Poultry disinfectant

A party of French students from the Ecole Nationale d'Aviculture at Rambouillet have recently been visiting agricultural establishments in Britain, under the guidance of the school's director, Henri Blachere, and its head of practical studies, M. Civel.

Their itinerary included a visit to an experimental broiler establishment operated by Alan Glasby & Co. Ltd., at Limpsfield to see a new system of poultry disease control. The system consists essentially of intercrop disinfection, coupled with a daily or twice-daily aerial misting of the broiler houses.

The disinfectant used is Ibcol Extra, developed by Jeyes Sanitary Compounds Co. Ltd., specifically to combat poultry diseases, Alan Glasby are manufacturers of a new aerosol generator, the Aircon Consol, which is used in the method.

The disinfectant and the aerosol generator used are said by the makers to have been specifically developed for the poultry industry, although the method is described as being capable of extension into other fields.

## Aryl-N-methyl carbamates

The importance of the aryl-N-methyl carbamates as insecticides has been emphasised by the success of Sevin (1-naphthyl-N-methyl- carbamate) marketed by the Union Carbide Corporation. A number of other chemicals in this category are showing considerable promise as they combine comparative safety in use with an unusual degree of insecticidal selectivity. Dow, Bayer, Hercules and California Chemical Co. are known to be currently working on the development of such carbamates as insecticides, and the discovery that piperonyl butoxide and other methylenedioxyphenyl compounds are potent synergists for them seems likely to have far reaching effects on the control of agricultural, domestic, industrial and public health pests during the next few years.

## Cockroach control film

Latest addition to the library of pest control films by Disinfestation Ltd. is a 16 mm colour and sound film on cockroach control called *The Intruders*. Made by the company's own Felcourt Film Unit, the film shows how these pests infest premises and how they can be eradicated by modern techniques. There are some extremely good close-ups of cockroaches and when one considers how these insects normally shun the light and are very quick moving, the film is a tribute to the patience and ingenuity of the producer, R. K. Farmer. The commentary is by James McKechnie.

*The Intruders* will be shown in conjunction with lectures given throughout the U.K. by members of Disinfestation Ltd. The company will be pleased to arrange lectures and film shows for interested organisations in London, or to accept invitations to give lectures and show the film to local organisations at their own venues.

## BWPA Members

The British Wood Preserving Association has announced that the following applications for "A" membership have been approved:

Borax & Chemicals Ltd. (35 Piccadilly, London, W.1); Pestroy Ltd. (22 West Hill Avenue, Epsom, Surrey); Cyril Ridgeon & Son Ltd. (Tenison Road, Cambridge); and the Timber Preservation Co. (8 Upper Drayton Place, Croydon, Surrey).

New "B" members are R. H. Chapman (of Ampfield, Hants.) and S. A. Johnston (of London, N.W.11).

#### Methods of Test for Toxicity of Wood Preservatives to Fungio B.S. 838:1961

*British Standards Inst., 2 Park Street, London, W.1. Price 7s. 6d. net.*

In this revision of B.S. 838, which was first published in 1939, the wood block method has been retained as the basis method of test for toxicity, but procedures are now given for determining both the initial toxicity of wood preservatives and the residual toxicity after leaching and evaporation. A test for toxicity to soft-rot microfungi is also included.

The principle of the tests is the exposure, to pure cultures of wood-rotting fungi growing under controlled conditions, of test pieces of a perishable type of wood that have received the prescrived treatment with the preservative under investigation. The standard gives details of culture vessels, medium for growing cultures, test fungi, species of wood used for test, treatment of wood blocks with preservative, conditioning after treatment, infection of blocks, examination of test blocks after exposure to attack, and evaluation of results. Descriptions of the test fungi and examples of test results are given in appendices.

Pending suitable experience with other organisms, the test for toxicity to soft-rot fungi is limited to one fungus, *Chaetomium globosum*, on a non-durable hardwood (beech). The desirability of extending the range of test organisms in due course is recognized.

It is emphasized in the foreword that laboratory tests of this kind, though very useful in assessing the potential value of a substance as a wood preservative, are in themselves insufficient for the evaluation of wood preservatives under practical service conditions and do not necessarily determine the amounts of preservative required to inhibit fungal attack on timber in service. This is because the tests are carried out under specified conditions which may not completely reproduce the conditions of treatment or exposure to which the timber is subjected in practice.

The foreword also emphasizes that this standard prescribes methods of test only and should not be used or quoted as a specification. A form of words indicating that a preservative conforms to B.S. 838 should not be used as it conveys no meaning.

#### Potato Growers Handbook

*By Dr. D. G. Hessayon and P. G. Fenemore. Published by Pan Britannica Industries Ltd. and Charles Lennig & Co. (G.B.) Ltd., Price 3s. 6d.*

This very attractive 34-page book has been published for the distributors of American Dithane in Britain, i.e. Pan Britannica, Shell Chemical Co. Ltd. and J. W. Chafer Ltd. By means of a super-abundance of charts, maps and drawings, the book sets out, for the benefit of the potato grower, the factors effecting the quality of the product, the advantages and disadvantages of main crop varieties, the selection and handling of seed, manures and fertilisers, and many other factors in potato growing. But the body of the booklet is, of course, concerned with potato diseases and pests and the recommended methods of overcoming them. It sets out in a very clear manner most of the diseases and troubles likely to be encountered in potato growing and briefly suggests suitable remedies for them. The Dithane method for preventing blight is explained and illustrated in some detail.

#### Pest and Disease Problems

*European and Mediterranean Plant Protection Org. Annual Report, 1960-61. E.P.P.O., 142 ave. des Champs-Elysees, Paris.*

The only parts of Europe still free from the Colorado beetle are the U.K., Scandinavia, the northern and eastern parts of the U.S.S.R., the southern parts of the Balkans and southern Italy. This infamous pest is spreading steadily eastwards and EPPO is giving attention to this serious problem. Blue Mould of tobacco is a well-established disease in North America and Australasia and appeared in Europe in 1958 and 1959 and spread alarmingly in the wet summer of 1960, causing losses estimated at about £10 million. These are among the pest and disease problems dealt with by EPPO and considered by the thirty countries which co-operate in its work.

#### Working Party on Pesticide Residue Analysis

*Published by Mediterranean Plant Protection Organisation (142 Ave., des Champs-Elysees, Paris.)*

Last September a working party set up by the organisation undertook a study of uniform and speedy methods of residue analysis, so that they could be used by public analysts and others for routine enforcement of regulations concerning toxic residues in human and animal food. This is the report of that working party, and it contains an account of the intensive discussions held on this problem.

Of special interest are two appendices to this report. One of these describes in considerable detail a recommended method for determining small amounts of DDT in flour and other foodstuffs.